What is claimed is:

1. A network node apparatus having an input terminal and an output terminal being each connected to a transmission line, which forms a bi-directional transmission path via said transmission line to another network node apparatus, comprising switching means for switching a signal sent out via said transmission path from said another network node apparatus to be folded back and output to said another network node apparatus again.

2. The network node apparatus according to claim 1, further comprising:

means for demultiplexing a wavelength multiplexed signal entered from said transmission line; and

means for multiplexing the wavelength demultiplexed signal again by exchanging said wavelength demultiplexed signal into a predetermined route.

3. The network node apparatus according to claim 2, further comprising wavelength conversion means for converting the wavelength of the signal sent out from said another network node apparatus into the wavelength of said wavelength demultiplexed signal.

4. The network node apparatus according to claim 1, further comprising a test signal sending component for sending out a test signal into said transmission path in response to occurrence of

a fault in said transmission line or said another network node apparatus,

wherein said switching means switches the test signal sent out via said transmission path from said another network node apparatus to be folded back and output to said another network node apparatus again.

5. The network node apparatus according to claim 3, further comprising a test signal sending component for sending out a test signal into said transmission path in response to occurrence of a fault in said transmission line or said another network node apparatus,

wherein said switching means switches the test signal sent out via said transmission path from said another network node apparatus to be folded back and output to said another network node apparatus again,

and said wavelength conversion means converts the wavelength of the test signal into the wavelength of signal on said transmission line where the fault has occurred.

6. The network node apparatus according to claim 4, further comprising determination means for determining the signal quality of the test signal by receiving the test signal to effect transmission control over said test signal sending component in accordance with the determination result.

7. The network node apparatus according to claim 6, wherein said determination means comprises a test signal receiving

component for receiving the test signal, and a determination portion for determining the presence or absence of the fault by comparing the signal quality of the test signal received by said test signal receiving component with a predetermined value.

8. The network node apparatus according to claim 6, wherein said test signal sending component notifies the determination result of said determination means to said another network node apparatus.

9. The network node apparatus according to claim 8, wherein said test signal sending component transmits the test signal after notifying said determination result.

10. The network node apparatus according to claim 6, wherein said determination means measures at least one of BER (Bit Error Rate), S (Signal)/N (Noise) ratio, the power of the test signal, and the wavelength of the test signal as said signal quality.

11. The network node apparatus according to claim 1, wherein the transparent transmission is performed.

12. A network system comprising a transmission line and a network node apparatus having an input terminal and an output terminal being each connected to said transmission line to form a bi-directional transmission path via said transmission line to another network node apparatus,

wherein said network node apparatus comprises switching means for switching a signal sent out via said transmission path from said another network node apparatus to be folded back and output to said another network node apparatus again.

13. The network system according to claim 12, wherein said network node apparatus comprises means for demultiplexing a wavelength multiplexed signal entered from said transmission line, and means for multiplexing the wavelength demultiplexed signal again by exchanging said wavelength demultiplexed signal into a predetermined route.

14. The network system according to claim 13, wherein said network node apparatus further comprises wavelength conversion means for converting the wavelength of the signal sent out from said another network node apparatus into the wavelength of the wavelength demultiplexed signal.

15. The network system according to claim 12, wherein said network node apparatus further comprises a test signal sending component for sending out a test signal to said transmission path in response to occurrence of a fault in said transmission line or said another network node apparatus,

wherein said switching means switches the test signal sent out via said transmission path from said another network node apparatus to be folded back and output to said another network node apparatus again.

16. The network system according to claim 14, wherein said network node apparatus further comprises a test signal sending component for sending out a test signal to said transmission path in response to occurrence of a fault in said transmission line or said another network node apparatus,

wherein said switching means switches the test signal sent out via said transmission path from said another network node apparatus to be folded back and output to said another network node apparatus again,

and said wavelength conversion means converts the wavelength of the test signal into the wavelength of signal on said transmission line where the fault has occurred.

17. The network system according to claim 15, wherein said network node apparatus further comprises determination means for determining the signal quality of the test signal by receiving the test signal to effect transmission control over said test signal sending component in accordance with the determination result.

18. The network system according to claim 17, wherein said determination means comprises a test signal receiving component for receiving the test signal, and a determination portion for determining the presence or absence of the fault by comparing the signal quality of the test signal received by said test signal receiving component with a predetermined value.

19. The network system according to claim 17, wherein said test signal sending component notifies the determination result of said determination means to said another network node apparatus.

20. The network system according to claim 19, wherein said test signal sending component sends out the test signal after notifying said determination result.

21. The network system according to claim 17, wherein said determination means measures at least one of BER, S/N ratio, the power of the test signal, and the wavelength of the test signal as said signal quality.

22. The network system according to claim 12, wherein said network node apparatus makes the transparent transmission.

23. A fault location detecting method for use in a network system having a plurality of network nodes (hereinafter referred to as nodes) connected via a transmission line, comprising steps for:

sending out a test signal from a terminal node of said transmission line to a working system path (current path) after switching said working system path to an auxiliary system path (stand-by path) in response to occurrence of a fault;

folding back the test signal to said terminal node in a node that has received the test signal; and

determining the signal quality of the test signal folded back to identify the fault location based on the determination result in said terminal node.

24. A fault location detecting method for use in a network system having a plurality of nodes connected via a transmission line, comprising steps for:

sending out a test signal from a terminal node of said transmission line to a working system path(current path) after switching said working system path to an auxiliary system path (stand-by path) in response to occurrence of a fault;

sending out the determination result to said terminal node by determining the signal quality of the test signal in a node that has received the test signal; and

identifying the fault location based on the determination result in said terminal node that has received the determination result.

25. A fault location detecting method for use in a network system having a plurality of nodes connected via a transmission line, comprising steps for:

sending out a test signal from a terminal node of said transmission line to a working system path (current path) after switching said working system path to an auxiliary system path (stand-by path) in response to occurrence of a fault;

sending out the determination result to said terminal node by determining the signal quality of the test signal in a node that has received the test signal;

identifying the fault location based on the determination result in said terminal node that has received the determination result; and

sending out the test signal from the node having sent out the determination result to said working system path if there is no fault detected during the operation of the identifying step.

26. The fault location detecting method according to claim 25, further comprising a step for extending the node for sending out the test signal by every one hop in succession from the node having sent out said determination result.

27. The fault location detecting method according to claim 23, wherein said terminal node is each of a start node and an end node of said transmission line.

28. A fault location detecting method for use in a network system having a plurality of nodes connected via a transmission line, comprising steps for:

sending out a test signal from each of a start node and an end node of said transmission line to a node located in the center of a working system path (current path) after switching said working system path to an auxiliary system path (stand-by path) in response to occurrence of a fault;

folding back the test signal to each of said start node and said end node in the node located in the center of said working system path that has received the test signal;

identifying the fault location based on the determination result by determining the signal quality of the test signal folded back at each of said start node and said end node; and

releasing the nodes outside a fault interval in said working system path to set up the other path, if there is any fault detected in either said start node or said end node during the operation of the identifying step.

29. A fault location detecting method for use in a network system having a plurality of nodes connected via a transmission line, comprising steps for:

sending out a test signal from each of a start node and an end node of said transmission line to a node located in the center of a working system path (current path) after switching said working system path to an auxiliary system path (stand-by path) in response to occurrence of a fault;

sending out the determination result to each of said start node and said end node by determining the signal quality of the test signal in the node located in the center of said working system path that has received the test signal;

identifying a fault location based on the determination result at each of said start node and said end node having received the determination result; and

releasing the nodes outside a fault interval in said working system path to set up the other path, if there is any fault detected in either said start node or said end node during the operation of the identifying step.

30. The fault location detecting method according to claim 23, further comprising a step for folding back a wavelength signal to said terminal node after converting the wavelength of the test

signal into the wavelength signal on said transmission line where the fault has occurred in the node having received the test signal.

31. The fault location detecting method according to claim 24, wherein the determination result is sent out using a channel that may or may not be different from the channel having received the test signal in the node that sends out the determination result to said terminal node.

32. The fault location detecting method according to claim 23, further comprising a step for extending the node for folding back the test signal by every one hop in succession from said terminal node.

33. The fault location detecting method according to claim 23, further comprising steps for:

extending the node for folding back the test signal by every plural hops in succession from said terminal node; and

reducing the number of hops for extending the node in the fault interval, if there is any fault detected during the operation of the extending step.

34. The fault location detecting method according to claim 23, further comprising steps for:

extending the node for folding back the test signal by every one hop in succession from said terminal node; and

folding back the test signal via the nodes outside said working system path, if there is any fault detected during the operation of the extending step.

35. The fault location detecting method according to claim 23, wherein the signal quality of the test signal is determining by measuring at least one of BER, S/N ratio, the power of the test signal and the wavelength of the test signal.